

Finger nail plate shape and size for personal identification – a possible low technology method for the developing world - Preliminary report

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SUMMARY

There is much documented information on abnormal fingernail shapes- acquired or congenital. There is a dearth of information on the shapes of the clinically healthy fingernail in medical textbooks and scientific journals. A study was carried out to determine the possible shapes of the healthy fingernails and the prevalence of each shape in the locality, i.e. in Ibadan, south-western Nigeria and to consider if there would be enough diversity in the shapes and sizes and their distribution on the different fingers to merit consideration for personal identification. The population included 496 consenting individuals, four family units and four sets of monozygotic twins. The latter two population samples were studied to assess the combinations possible within families and in monozygotic twins. Seven gross fingernail shapes were identified in the study population. Examination showed variations within members of the families i.e. no two members had identical shapes in the pair of hands. Examination of 4 sets of identical twins showed no difference in the shapes and sizes of the fingernails on each finger. It would appear that the finger nail plate shapes /sizes of the hands show diversities similar to finger prints and therefore can be considered and developed further for personal identification in developing countries such as Africa

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Introduction

There is much documented information on abnormal fingernail shapes- acquired or congenital e.g. Onychogryphosis, median nail dystrophy, ectodermal dysplasia, yellow nail syndrome, koilonychia, nail-patella syndrome, Beau's line, and racket nail. There is a dearth of information on the shapes of the clinically healthy fingernail in medical textbooks and scientific journals. While searching the Internet

some information was found relating to fingernail plate shapes to palmistry and fashion.

Aims and objectives

A study was planned to determine the possible shapes of the healthy fingernails and the prevalence of each shape in the locality, i.e. in Ibadan, south-western Nigeria and to consider if there is enough diversity in the shapes and sizes and their distribution on the different fingers to merit consideration of the fingernail plate for personal identification.

Material and Method

The shapes of the fingernails in 496 consenting individuals were documented to decide the various gross shapes in Ibadan as well as the incidence of the various shapes observed. Having found the shapes present in the locality, four nuclear families (father-mother -siblings) and 4 sets of identical twins were studied to assess the combinations possible within families and in the monozygotic twins. Various formats for documenting the finger shapes were: tried-tracing paper, photographs and the use of the ratio of the vertical /horizontal measurements. Where the fingernails were kept long, the distance between the cuticle and the free edge was considered as the actual shape (**Fig. 1**).

Some nomenclatures were adopted for the study for the ease of documentation and reference. R and L refer to the right and left hands respectively. "Small" or "large" refer to the size of the nail plate relative to the distance between the distal dorsal ridge and the cuticle (**Fig 1**). If the nail plate is equal to or longer in its vertical dimension it was documented as 'large' and 'small' on the contrary. T refers to the thumb, and the other fingers were index (I); middle finger (M); ring finger ® and the little or last finger (L) respectively.

Exclusion criteria

The following were excluded from the population studied

- Severe injury to the hands and or nails (post trauma e.g. road traffic accident or post surgery)
- Severe infection of the fingernails by fungi
- The wearing of artificial nails.

Results

General initial survey for incidences of nails shapes in the community

496 subjects formed the population sample for the first phase of the study. Seven gross fingernail shapes (A-G) were identified in the study population as shown in **Fig 2**.

Table 1 shows the incidence of each of the finger shapes. The most common shape was a 'triangle' with the apex (which was rather broad) pointing downward. This accounted for 29.6 % of the finger nail plates. The 'gross' shape is referred to because no nail plate conformed to a perfect geometrical shape. While a shape can be said to be prominent or common on the pair of hands, variations existed between the fingers and from one hand to the second (of each pair), e.g. while 7 fingers may be classified as 'square', two other fingers may be rectangular upwards and the last finger may be triangular. There were a few shapes which may be considered 'borderline' – between the identified gross shapes, and which are best documented by photography or tracing on paper than by non visual form of communication.

The result showed marked variations in the finger nail shapes and sizes. Photography is the simplest (though not cheapest) best reproducible form of keeping such a document. However there was a slight technical problem with this format. It was not feasible to show all 10 fingers on the hands in the same photograph without losing details of the shapes of the thumbs. The best reproduction will be captured in two photographs; one showing the eight fingers together, and another showing the thumbs together – all the fingers placed flat on a surface during photography. A possible format for documentation of the finger nail shapes from tracing paper is shown in **Table 2**. The outcome of the use of the ratio of vertical / horizontal dimensions of the nail plate is shown in **Table 3**.

Nuclear families

Examination showed variations within members of the families i.e. no two members had identical shapes in the pair of hands going by the parameters of size of fingernail plates, and the shapes and distribution of shapes in both hands of each subject (**Table 4**).

Identical twins

Examination of 4 sets of identical twins showed no difference in the shapes of the fingernails on each finger, distribution and fingernail plate sizes. (**Table 5**)

Fig 1. The Fingernail

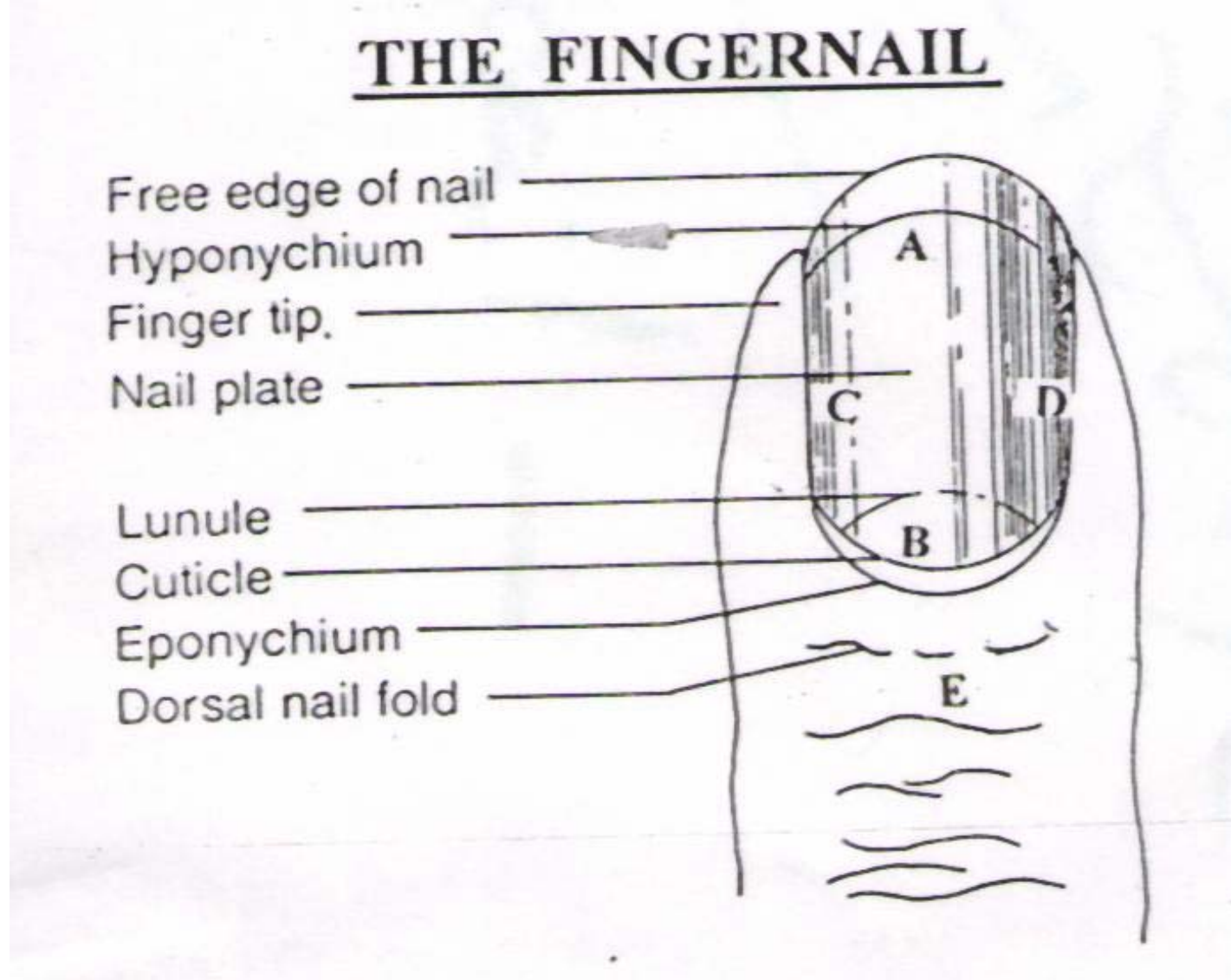


Figure 2 (a-g)

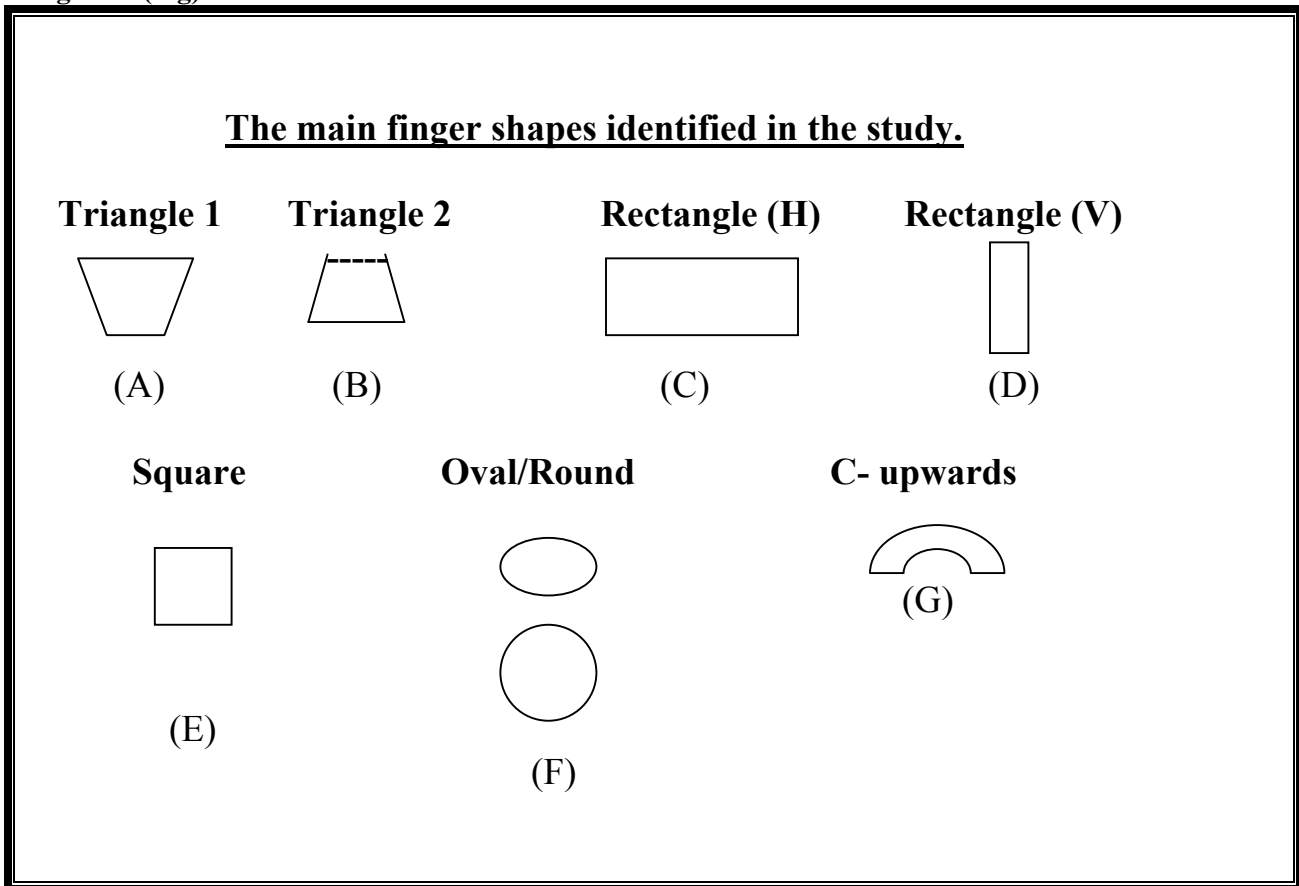


Table 1: Fingernail shapes in the study population. N=496

FINGER SHAPE	NOMENCLATURE	PERCENTAGE
Triangle 1	A	29.6
Triangle 2	B	0.8
Rectangle (H)	C	16.1
Rectangle (V)	D	27.0
Square	E	12.9
Oval /round	F	12.7
C-upwards	G	0,8

Table 2 : Documentation of Fingernails shapes using gross shape

R] T {E } - I {E } - M {E } - R {V } - L {A }

Small

L] T {E } - I {E } - M {E } - R {V } - L {F }

Small

Table 3 : Documentation of Finger nails shapes using ratio of the longitudinal to the horizontal dimensions of the nail plate

R] T {1.0}- I {1.0} - M {0.9}- R {0.3}- L {1.7}

Small

L] T {1.0}- I {1.0} - M {0.9}- R {0.3}- L {1.4}

Small

Discussion

Finger printing is one of the well-known forms of identification using physical traits. It is not completely without its setback. It can be accidentally marred by physical, thermal or chemical injury. It can be altered surgically or by the application of materials to alter the skin surface by criminally orientated individuals. More important is that it requires great expertise for correct interpretation. It can be recorded as a 'rolled print' when each finger is rolled on an ink plate and the finger rolled on the paper or form. It may be recorded as 'plain prints'. In this instance all the fingers are pressed in the ink at the same time and then pressed on the form. The thumbs are held together and printed in the same way. There are four patterns of fingerprints: whorls, loops arches and compounds. Apart from identical twins (if the fingers are not affected by trauma) no two individuals have identical fingerprints. Moreover the prints are different on each finger and thumb. Other less well-known, or less useful, less practical means of bodily identification include Rugoscopy, the study, interpretation, and evaluation of the palatal ridges and grooves (ruggae). Cheiloscopy (quieloscopy) [1, 2, 3] is the study, interpretation and evaluation of the labial (lip) surfaces - cracks, crevices, wrinkles and grooves.

Banks in the developing countries of Africa still and often utilize finger printing because of the level of illiteracy of the people. Although two prints may have the same pattern they will not have the same number and arrangements of ridges. The bank officials cannot confirm the true identity of the customers from such fingerprints during the transaction at the counter.

Fingerprints will also not be useful in accrediting or confirming the identity of potential voters in developing countries right in the polling room. This is one of the reasons for considering the fingernail plates as a possible anatomical feature that could be of practical importance for personal identification in a developing country such as Nigeria.

Available information on fingernail plate shapes during literature search was from the Internet on web sites for palmistry and cosmetology and fashion [4,5]. Four main shapes were identified from these sites. It was claimed that '**Broad and square**' nails reveal an easy going calm, honest, patient, upright, balanced and broad minded person. '**Short wide nail**' was associated with a temper that can flare up quickly. '**Almond shaped nails**' are said to be the most beautiful of all shapes. They are believed to reveal a person who is gentle, refined sensitive and creative. '**Short nails**' in a similar manner to short fingers reveal a tendency towards impatience, and quick thinking, and the shorter the nails, the more critical the nature. '**Long nails**' that are also wide were reported to have the same meaning as the square nail but when long nails are also narrow, the character will be prone to selfishness and narrow-mindedness. '**Very small square nails**' that are neither long nor wide that appear to be dwarfed by the finger reveal a person who can be tight fisted, mean and stingy. '**Fan shaped**' nails with a narrow base that widen out towards the top of the finger like a fan, indicate highly strung and nervous people.

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Table 4: Gross finger shapes on the hands of members four families

	SZ	T	I	M	R	L				SZ	T	I	M	R	L	FAMILY
1	S	E	A	A	A	F				S	E	A	A	D	F	1
2	L	D	D	D	A	A				L	D	D	C	D	D	
3	L	A	A	A	E	A				L	A	A	E	E	A	
4	S	C	C	D	C	E				S	C	D	D	C	E	
5	L	E	D	D	D	D				L	E	D	D	D	E	
6	S	A	A	F	F	A				S	A	F	F	F	F	2
7	L	C	C	C	C	A				L	C	C	D	C	C	
8	L	F	F	F	C	A				L	F	F	C	C	C	
9	L	D	D	D	C	C				L	D	D	C	D	A	
10	L	A	A	E	E	E				L	A	A	A	E	E	3
11	S	C	C	C	E	E				S	C	C	E	E	C	
12	S	A	A	F	F	A				S	A	F	F	F	F	
13	L	E	A	F	F	A				L	E	D	F	F	C	
14	L	C	C	E	A	A				L	C	C	C	A	F	4
15	L	C	C	E	E	E				L	C	C	C	E	C	
16	S	D	D	D	D	E				S	D	D	D	E	E	
17	S	D	D	A	A	F				S	D	D	D	A	A	
18	S	F	F	C	C	A				S	F	F	F	A	A	
19	L	D	D	E	E	D				L	D	E	E	E	D	

RIGHT HAND

LEFT HAND

SZ – Size of Fingernail
M - Middle Finger

T – Thumb
R - Ring Finger

I - Index Finger
L - Little Finger

Table 5: Gross finger shapes on the hands of four sets of monozygotic (identical) twins

	SZ	T	I	M	R	L				SZ	T	I	M	R	L
1a	L	A	A	E	E	E				L	A	A	E	E	E
1b	L	A	A	E	E	E				L	A	A	E	E	E
2a	S	A	A	F	F	A				S	A	A	F	F	A
2b	S	A	A	F	F	A				S	A	A	F	F	A
3a	S	D	D	A	A	F				S	D	D	A	A	F
3b	S	D	D	A	A	F				S	D	D	A	A	F
4a	L	E	D	D	D	D				L	E	D	D	D	D
4b	L	E	D	D	D	D				L	E	D	D	D	D

RIGHT HAND

LEFT HAND

SZ – Size of Fingernail
M - Middle Finger

T – Thumb
R - Ring Finger

I - Index Finger
L - Little Finger

Beyond the realm of palmistry and fashion an attempt was made in this study to have shapes that could be better categorized by size (Large or small) (**Fig.1**) and shapes – **A – G** (**Fig. 2**).

There are comparable features between the fingernail shapes and fingerprints. There are four basic fingerprints. 7 gross fingernail shapes were identified in this study. No two fingers have the same fingerprints. Similarly no two fingers had the same nail plate shape and size. The departure from perfect geometric shapes accounts for the uniqueness. The fingerprints on fingers of one hand are different from those of the second pair; this is similar for nail finger shapes in a pair of hands. The fingernail plates because of their sizes relative to fingerprints that require study and assessment under a magnifying glass should offer a swifter way of identification e.g. at the cash point in the bank or at a voting center. Just as fingerprints can be destroyed accidentally or deliberately by physical or chemical trauma, nail plates can be affected by trauma and infection especially fungi. It must be remembered however that a positive identification is accomplished only by comparison with a known sample. A set of two photographs of the dorsal aspect of the hands at the time of opening an account can become a standard for comparison. Photography as mentioned earlier on is the simplest and best reproducible form of keeping such a document. It is also possible to use some nomenclature for documentation as shown in **Tables 2 and 3**. Using the format in **Table 2** (gross shapes) has much limitation because there are squares of different sizes and the fingers nail plate shapes are not perfect geometric shapes.

Documentation using ratio of the vertical to the horizontal dimension of the nail plates (**Table 3**) has some drawback. The limitation with this format is that it becomes difficult to distinguish shapes such as oval, triangle and round from one another since the horizontal dimension taken midway will vary for these different shapes. Another possible though not experimented with in this study is the use of "pictogram"/stamps in the shape of the hand/fingers. The observed shape can be affixed on the fingers of each hand. This would be useful in the rural/primary health care center for keeping records in case notes. These various methods have merits and demerits regarding

cost, reproducibility and accuracy. Using the finger nail shapes would seem to have great potential in identification of individuals following mass disasters (air plane crash, genocide victims), abducted children who may not be able to give details of their parents' particulars, unconscious patients of road traffic accidents. The method is limited by destruction of the nails by dermatophytes and traumatic injury to the hands/fingers. An electronic hand-scanning machine using the geometric shape of the hand has been tried in a limited way in institutions in the USA - such as in students' cafeteria [6].

The first recorded use of fingerprints was by the ancient Assyrians and Chinese for the signing of legal documents [7] Probably the Czech physiologist Johannes Evangelista Purkinje, who in 1823 proposed a system of classification that attracted little attention, made the first modern study of fingerprints. The use of fingerprints for identification purposes was proposed late in the 19th century by the British scientist Sir Francis Galton, who wrote a detailed study of fingerprints in which he presented a new classification system using prints of all ten fingers, which is the basis of identification systems still in use. In the 1890s the police in Bengal, India, under the British police official Sir Edward Richard Henry, began using fingerprints to identify criminals. As assistant commissioner of metropolitan police, Henry established the first British fingerprint files in London in 1901 [7] Subsequently, the use of fingerprinting as a means for identifying criminals spread rapidly throughout Europe and the United States, superseding the old Bertillon system of identification by means of body measurements. Today, law enforcement agencies can also use computers to digitally record fingerprints and to transmit them electronically to other agencies for comparison.

Conclusion

It would appear that the fingernail plate shapes of the hands show diversities similar to finger prints and therefore can be utilized for identification in developing countries such as Africa- in hospitals, banks, and airports and as requirements for pre-employment or pre-

admission to educational institutions and for voting during election period in a developing country. It is hoped that like finger printing the method of personal identification using finger nail plate shape and size would rise as finger printing did from a simple beginning by the ancient Assyrians and Chinese for the signing of legal documents to the scientific up liftment and refining that is possible today.

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